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Performance Analysis of Radio over Fiber with Wdm PON System

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ABSTRACT : Radio over fiber is becoming an increasingly important technology for the wireless market since it introduces a good data transmission rate and large bandwidth. We have implemented a bidirectional radio over fiber (ROF) system. It is combination of SCM-ROF and optical wavelength division multiplexing (WDM) techniques to simplify the access network architecture. The combination of two different types has been performed to provide high bit data rate and wide bandwidth in cellular communication. The system allows different Base Stations (BS's) to be fed by a common fiber. Different wavelength channels can be allocated to different BSs depending on user requirements.We have also presented an investigation on the performance of sub-carrier Multiplexing (SCM) system in terms of degradation of channel capacity, variation of optical input power and variation of number of subcarriers.

KEYWORDS : WDMPON,OLT (optical link terminal), (ONU optical network unit), EDFA (erbium doped fiber amplifier), BER(bit error rate), OSNR (optical signal to noise ratio),SCM (sub carrier multiplexing),Mobile switching center(MSC),Base Station (BS),Central Site (CS),Remote Site(RS).

INTRODUCTION : Nowadays, there is an increasing demand for broadbandservices which leads to ever-growing data traffic volumesover these services. In addition to thehigh-speed, symmetric, and guaranteed bandwidthdemands for future video services, the next-generationaccess networks are driving the needs for the convergenceof wired and wireless services. Radio-over-FiberTechnology, the integration of microwave and opticalnetworks is a potential solution forincreasing capacity and mobility as well as decreasingcosts in the access network, by RoF. The concept ofRoF means to transport information over optical fiber bymodulating the light with the radio signal. Thismodulation can be done directly with the radio signal orat an intermediate frequency. RoF technique has thepotentiality to the backbone of the wireless accessnetwork. Such architecture can give several advantages,such as reduced complexity at the antenna site, radiocarriers can be allocated dynamically to the differentantenna sites, and Transparency and scalability.

The main goal of these RoF systems is to reduceinfrastructure cost and to overcome the capacitybottleneck in wireless access networks, allowing at thesame time a flexible merging with conventional opticalaccess networks. Thus, in order to design a reliable RoFbasedaccess infrastructure, RoF techniques must (a) becapable of generating the microwave signals and (b)allowing a reliable microwave signals transmission overthe optical link. The Optical Frequency Multiplicationmethod satisfies these two main requirements bygenerating the microwave signals with a single laser source and low frequency. Among many other RoFtechniques, the Optical Frequency Multiplication Principle proposed in is a cost-effective and dispersiontolerantmethod to optically generate microwave Frequencies and deliver wireless signals to a remote AS.
RoF technology is a technology by which microwave (electrical) signals are distributed by means of optical components and techniques. A RoF system consists of a Central Site (CS) and a Remote Site (RS) connected by an optical fiber link or network. If the application area is in a GSM network, then the CS could be the Mobile Switching Centre (MSC) and the RS is the base station (BS). For wireless Local Area Networks (WLANs), the CS would be the head end while the Radio Access Point (RAP) would act as the RS.

SET-UP MODEL : The setup model of the work is incontestible below (fig no 1). the whole started model consists of 4 distinct circulator 2 for downstream and another 2 for up-stream.The model is meant for the each of the up-and-down stream transmission consisting of the 2 set within the OLT and ONU aspect severally. the mix of electrical and optical signal is allowed to submit to the mach-zehnder modulator from each OLT.WDM mux(2×1) combined the signals of OLTs.after that combined signal is allowed to

submit to EDFA and at the moment circulator.further signal is allowed to submit to bifacial optical fibre.

Fig no. 1. set-up model of proposed model

RESULT & DISCUSSION : Plotting of different parameters has been demonstrated below. very first graph is plotted in between gain/ output power V/S length of optical fiber. As the length of optical fiber increases the gain and output power both are decreases. we can see in fig. no. 2, output power is decreases rapidly than the gain .the gain and output power has been taken for the downstream. this decrement in gain and output power limit the distance of communication.

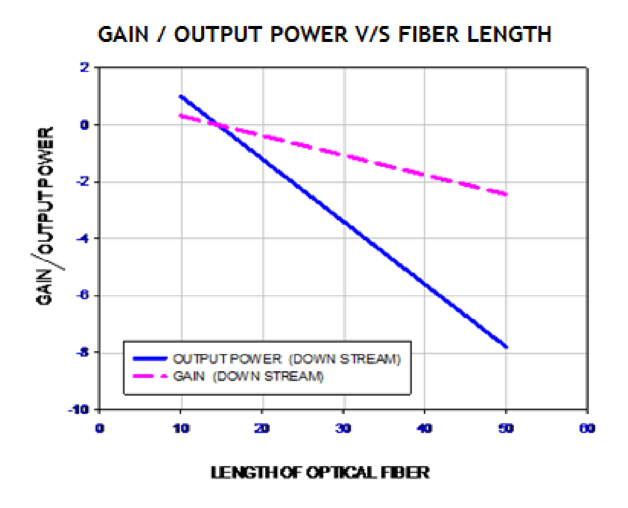


Fig no.2. Gain /output power v/s fiber length.

Fig. no. 3 shows the relation between RF voltage and power that is taken in dBm.Horizontal axis shows the RF voltage and vertical showing power in dBm.As the RF voltage increases the power is linearly increases. This linear relation show that output power is directly proportional is to the RF voltage.

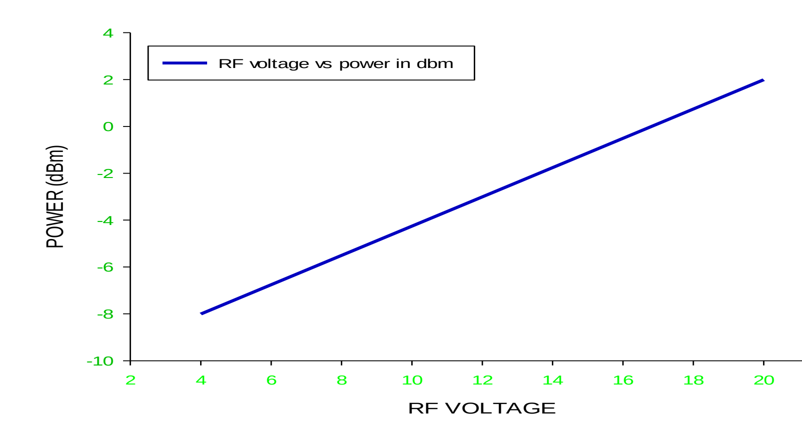


fig. no.3.Power v/s RF Voltage.

In gain control mode we set the desired amplifier gain (in dB units), which is given by the ratio of the total output power (Pout) and total input power, including (or note including) the generated ASE.there are no additional iterations or complicated equation solution in this mode. The graph between Q factor and power is given in fig no.4 .

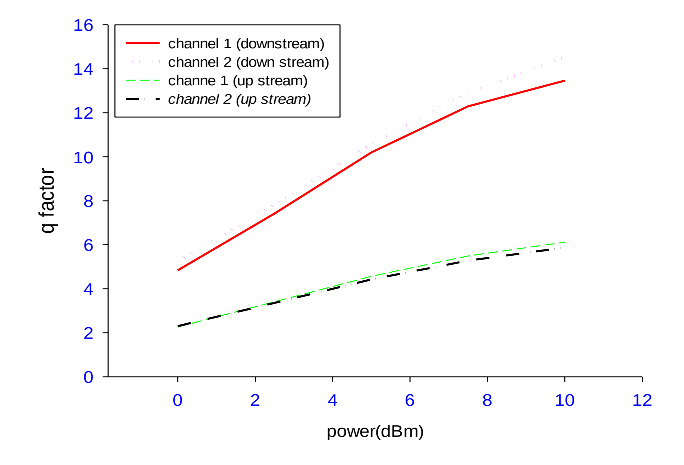


Fig no.4. Q factor v/s power

The graph between BER and power of gain control mode is given in fig. no. 5.

PERFORMANCE IN GAIN CONTROL MODE

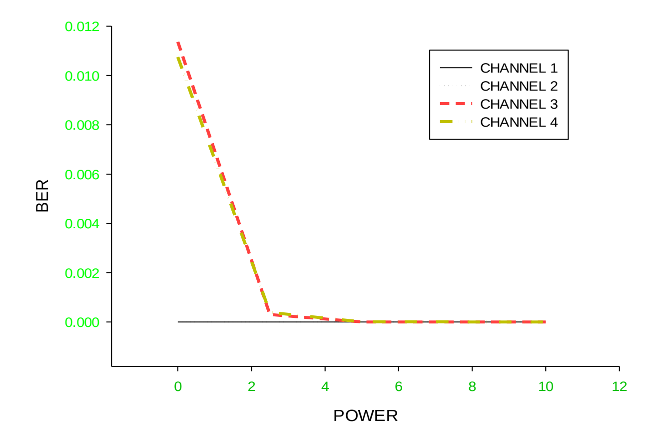


fig. no. 5. Bit Error Rate v/s Power

CONCLUSSION

There are few major limitations of this technique. The radio over fiber has enough bandwidth to support many wideband wireless channels. When the radio frequency is a few giga hertz and the fiber length is a few kilometers, dispersion is small and is not a concern. However, when the wireless link is in the series with the optical link, the non-linear distortion in the optical link increases considerably and it can’t be ignored.

REFFERENCES

i. *Minhong Zhou, "Novel Modulation Technique for Radio-over-Fiber Systems," Concordia University, Canda, Thesis 978-0-494-40900-8, 2007.*

ii. *A.M.J. Koonen et al, ‘Perspectives of radio over fiber technologies’, 2008 Conference on Optical Fiber Communication/National Fiber Optic Engineers Conference (OFC/NFOEC 2008), San Diego, CA, 24 - 28 February 2008, pp. OThP3-1/3*

iii. *H.D. Jung et al, ‘All-optical multicasting of millimeter-wave signals using optical frequency multiplication technique for in-building networks’. Proceedings of the 35th European Conference on Optical Communication (ECOC 2009) 20 - 24 September 2009, Vienna. pp.4.5.3-1/2*

iv. *H. Yang et al, ‘OFDM radio-over-fiber systems employing routing inmulti-mode fiber in-building networks’, proc. 34st EuropeanConference on Optical Communications (ECOC 2008), Tu4F6, 21-25September 2008, Brussels, Belgium, 2008.*

v. *A.M.J. Koonen, ‘Radio-over-MMF techniques - Part II: microwave tomillimeter-wave systems’. Journal of Light wave Technology, 26(15), 2396-2408.*

vi. *H. Yang et al, ‘High Capacity Radio-over-Fiber Systems forMulticarrier Signals with Dynamic Routing’, Proceeding of 22nd Annual Meeting of the IEEE Photonics Society (Photonics Annual2009), Antalya, Turkey, 3 – 8 October 2009, Paper WG 3.*

vii. *Hyun-Seung Kim, "Bidirectional WDM-RoF Transmission for Wired and Wireless Signals,"inProc. of SPIE-OSA-IEEE , Asia, 2009, pp. 76320-76322.*

viii. *Tashiro, T., et al., \Experimental demonstration of RoF-DAS over WDM-PON with band pass-Sampling and optical TDM techniques," IEICE Electronics Express, Vol. 9, No. 3, 206{212,Feb. 2012.*

ix. *Tashiro, T., et al., \40km ¯ber transmission of time domain multiplexed MIMO RF signals forRoF-DAS over WDM-PON," OFC/NFOEC 2012, OTu2H.4, Mar. 2012.*